



U.S. Department
of Transportation

**Federal Aviation
Administration**

Memorandum

Subject: **INFORMATION:** Installation Approval of Multi-Function Displays Using the AML STC Process;
Policy Statement PS-ACE100-2002-002

Date:

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1.0 Introduction

1.1 What is the purpose of this Policy Statement?

This policy is to encourage use of the Approved Model List (AML) Supplemental Type Certificate (STC) AML STC approval process. It is designed to provide guidance to:

- FAA Engineers and Inspectors
- FAA Engineering and Airworthiness Designees
- Equipment manufacturers
- Aircraft modifiers
- Avionic equipment installers

1.2 What is the scope of this Policy Statement?

This policy focuses on the use of the AML STC for installation of multiple function displays (MFDs) in Civil Air Regulations (CAR) 3 or 14 CFR part 23 airplanes or sailplanes, balloons, or airships operating under part 91, and/or part 135 rules.

It does not introduce new policy or regulation but provides a compilation of existing regulation, guidance and procedures in the application of the AML STC process for certification projects. The AML STC process may be used whenever the ACO and applicant agree that it is appropriate.

The AML STC process may also be effective for a certification project of an aircraft under another certification basis such as Bulletin 7-A. The applicant should coordinate with the appropriate ACO for final determination.

1.3 What limitations are there on the MFD installation using this policy?

- MFD does not provide functions considered essential for continued safe operation.
- MFD does not provide information required by part 23 or CAR 3 or other predecessor certification rules or part 91 and/or part 135 operating rules.
- Normal operation or failure modes of MFD will not adversely affect systems providing functions essential for continued safe operation.
- The MFD only provides advisory information and does not provide a source for primary or required flight information. Advisory information is typically an aid to situation awareness, determination of system status, and reduction of pilot workload.

2.0 Approved Model List STC

2.1 What is an AML STC?

An AML STC approval process utilizes a single approval for STC to type certificated products that were originally approved separately. For example, an AML may list a Piper P-28 along with a Cessna 150, a Stinson 108, and so on. The AML is attached to the STC (FAA Form 8110-2) and lists the type certificated products eligible for installation of the STC and their respective FAA approved documents. Whenever a type certificated product is added or a document is amended, deleted, or added, the AML is revised and approved, not the STC. The AML revision process should be established during the initial AML STC certification. Reference FAA Order 8110.4B, Type Certification, chapter 4-2(a)(4) for more guidance.

The AML STC approval process develops a set of installation instructions that can be used to install equipment on several different type certificated products. These instructions include general installation guidelines and specific installation instructions.

The general guidelines reference standard practices and procedures such as electrical wire selection as specified in Advisory Circular (AC) 43-13. Due to the similarity of installation across the approved models, much of the installation instructions can be general in nature.

Specific installation instructions address more critical elements of the installation such as antenna placement. Specific instructions also address any specific installation differences between eligible models.

The STC with Approved Model List will be referred to as an AML STC throughout this document.

2.2 How do I begin the AML STC process?

The AML STC is a certification process and will require direct contact with the Aircraft Certification Office (ACO) engineering staff. To start a certification project, the applicant will submit FAA form 8110-12 to the geographically responsible ACO. A list of ACOs is contained in Appendix 7 of FAA Order 8110.4B. Additional guidance on the STC process can be found in Advisory Circular 21-40.

The applicant will be expected to submit their certification program plan following FAA Order 8100.5 paragraph 400.b.

An acceptable program plan is the Project Specific Certification Plan that is part of the Certification Process Improvement (CPI) approach. The applicant may also elect to use an alternative certification program plan method coordinated with the ACO.

2.3 Why use the AML STC certification approach for the installation of MFDs?

The use of an AML STC is beneficial to the FAA and the applicant when installing MFD equipment as it offers a streamlined method of approving multiple model installations. This method may reduce the number of follow-on approvals that would be required for additional airplane models. In addition, this method is intended to encourage the proliferation of advanced avionics into GA aircraft.

Generic installation instructions are used to install the equipment in multiple aircraft models under a single approved STC document. This results in less paperwork and workload to both the applicant and the FAA.

It is important that the applicant and the ACO agree to the use of this method early in the project. Together they should review the installation instructions to verify their applicability for the aircraft models requested along with conformity inspection and flight test requirements.

The AML STC approach streamlines certification in several areas:

- One STC provides a wide applicability list
- Master installation instruction set versus model specific instruction sets
- The number of conformity inspections is reduced
- The number of flight tests is reduced
- Additional models can be added without revising the original STC

2.4 How is revising the AML STC more streamlined than revising a standard STC without an AML?

If an existing STC contains an AML, the STC holder may add models to the AML through an approved revision process. The AML revision does not involve revising the entire STC, only the AML. This reduces the time and effort required to add models to the STC.

A procedure to revise the AML by the STC holder should be included in the original STC application. This ensures a method of revising the AML without revising the STC itself. The procedure should provide guidance on what engineering data will be required to add models to the AML along with any additional requirements for conformity inspections, flight or operational tests.

Any revision to the AML requires FAA approval.

An additional advantage is the ability to reduce or eliminate the need for conformity inspections for the model(s) added.

3.0 Background

3.1 What experience have we had using the AML STC process to install MFDs?

We have gained practical experience with the Alaska Capstone program in using the AML STC process as a method of approving MFD installation on a wide variety of aircraft under a single STC.

Alaska's Capstone program is a government and industry collaborative effort to improve operational safety through the deployment of safety enhancing airborne and

ground-based technologies. You can learn more about the Alaska Capstone program and review the AML STC documents at <http://www.alaska.faa.gov/capstone/>.

3.2 What have we learned from the Capstone program?

The Capstone program has demonstrated that a more streamlined approach for installation approval is appropriate for MFDs and will encourage installation by further reducing installation approval costs.

The AML STC approval method was used in Capstone. With this approach, the equipment manufacturer provides installation instructions valid for the airplanes for which approval is being sought. Thus, only one data set has to be reviewed by the FAA. “The FAA and Industry Guide to Avionics Approvals” provides additional discussion on the AML STC process.

4.0 Certification Plan Development

4.1 How do I develop a certification plan for an AML STC?

Currently, CPI provides a structured approach to the project management of a certification program. It describes how to plan, manage, and document an effective, efficient product certification process between the FAA's Aircraft Certification Service and applicants.

The FAA and applicants will use this process for Type Certification (TC), significant STC, and significant amendments to either TC or STC.

The process has two major parts:

- The Partnership for Safety Plan (PSP) establishes an early and formal written working relationship between the FAA and the applicant
- The Project Specific Certification Plan (PSCP) is meant to define and document a specific product certification plan between the FAA and the applicant to expedite a certification project under standardized procedures.

FAA Notice N8110.80 introduces the current CPI process and outlines how the process functions.

4.2 What guidance is there for developing a Partnership for Safety Plan and Project Specific Certification Plan?

The FAA, in coordination with the Aerospace Industries Association (AIA) and the General Aviation Manufacturers Association (GAMA), have introduced “The FAA and Industry Guide to Product Certification” and "The FAA and Industry Guide to Avionics Approvals."

These documents describe the design and production certification process for aircraft. They describe how to plan, manage, and document an effective and efficient product certification process. The FAA and the applicant should use these guides to develop the PSP and the PSCP for certification projects.

5.0 AML STC Considerations

5.1 What is involved with the equipment design approval of MFDs?

Basically, there are two steps: Design Approval of the equipment and Installation Approval of the equipment as installed in the aircraft.

Design Approval of an MFD is through issue of a Technical Standard Order Approval (TSOA) for the appropriate functions the MFD is capable of displaying) or meeting the requirements applicable to the equipment. Design Approval is needed because these systems may interface with other airborne systems and minimum requirements should be met to ensure proper operation without interference to other installed systems. Read FAA Order 8150.1A for further guidance on TSO procedures.

Installation Approval of non-required systems normally involves an installation review to verify the equipment will not adversely affect existing equipment to perform their intended function(s) or induce a hazard into the airplane.

A Functional Hazard Assessment (FHA) should be performed to identify and classify failure conditions including determining probable combinations of failures. Guidelines and reference materials that can be used in performing a FHA can be found in AC 23-1309-1C.

Section 5.2 discusses considerations for equipment design qualification. The applicant should discuss with the appropriate ACO personnel, early in the project, any requirements for equipment design qualification.

5.2 What are other considerations for equipment qualification

There are several industry and government references that address equipment qualification.

Industry Document References:

- RTCA Inc., Document DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment.
- RTCA Inc., Document DO-178B, Software Considerations in Airborne Systems and Equipment Certification.

Note 1: You can get the above documents from RTCA Inc, 1828 L Street, NW, Suite 805, Washington D.C. 20036 (<http://www.rtca.org>).

- Underwriter's Laboratories Inc., Document UL 1418, Implosion Protected Cathode Ray Tubes for Television-Type Appliances. This document can be obtained from the Underwriter's Laboratories Inc., Publications Stock, 333 Pfingsten Road, Northbrook, IL 60062 (<http://www.ul.com>).
- Technical Standard Orders. If an applicable Technical Standard Order (TSO) exists, the equipment manufacturers must meet the minimum standards defined in the TSO. For non-required, situation awareness only equipment, an equipment manufacturer must specify the performance that the equipment is intended to meet. The equipment manufacturer may determine the environmental categories using DO-160D and the software categories using DO-178B. Notice 8110.92 provides guidelines for applying the RTCA DO-178B Level D criteria to previously developed software (PDS).

TSO-C113 defines the minimum performance standards for airborne MFDs. Any additional performance standards for multiple functions of the MFD such as terrain awareness information would require compliance to additional TSO requirements when applicable.

Refer to FAA Order 8150.1B for additional guidance on TSO procedures.

The equipment manufacturer should provide installation instructions including pin layouts, wiring diagrams and structural mounting means. If an antenna is required, the equipment manufacturer should provide the installation details for its installation.

The manufacturer should provide electrical load requirements for each piece of equipment to facilitate an electrical load analysis for the installation.

Only wire specifically designed for airborne use should be installed in aircraft. AC 43.13-1B provides acceptable guidance on selection of wiring to be used on aircraft. Choosing wire from AC 43.13-1B will permit wire approval without further showing including flammability requirements.

The primary electromagnetic interference (EMI) concern is that the MFD does not interfere electrically with any other installed equipment. EMI tests should conform to DO-160D, Section 21 for Conducted Radio Frequency (RF) Interference and radiated RF Interference to Category “Z” for both tests unless the equipment manufacturer can justify a lower level.

Other installation considerations such as system interfacing and the use of software based systems should be addressed during the certification project to ensure the installation does not introduce conditions that could lead to degradation of those systems essential for continued safe operation.

The FAA has, and continues, to approve installations on a non-hazardous basis. The FAA’s primary concern is that any device installed not interfere with any of the required equipment. A safety assessment conducted per guidelines outlined in AC 23.1309-1C will determine the acceptable level of safety required including Software Development Assurance levels.

FAA AC 23.1311-1A, Installation of Electronic Displays in Part 23 Airplanes, provides additional acceptable guidance for the installation of MFD equipment.

Any additional concerns regarding design approval should be discussed with ACO engineering personnel as part of the PSCP process.

5.3 What conditions should be met when developing an AML STC to install MFDs?

FAA Order 8110.4B, Chapter 4, provides the following guidance:

- STC data package consists of a principle design and certification data package for the change and either a master installation package for all eligible type certificated products or a separate installation package for each eligible type certificated product.
- Any design or installation differences between eligible products are identified in the design and installation data.
- Installation complexity is similar on all eligible products.

- The change does not require a substantial reevaluation of the type certificated product's airworthiness.
- The type certificated product flight or operational characteristics remain unchanged.
- The eligible type certificated products and FAA approved documents are listed on a special page known as the AML attached to the STC.

5.4 What considerations should be made when developing AML STC installation instructions?

Installation instructions for an AML STC must give adequate instruction for each approved airplane model. The installation procedure for this type of equipment should be similar from make and model of one aircraft to another.

The approach taken with the AML STC provides the installer with FAA approved installation guidance that is applicable to a variety of small airplanes. Any installation differences must be identified in the installation instructions including any issues about interfacing with other installed equipment.

The installation instructions should include procedures for determining the placement, installation, and post installation equipment checkout. Post installation check out procedures may include checking structural and electrical loads, external data source tests, software and database test, Electromagnetic Interference (EMI) test, altitude tests, magnetic heading interference test, interface test, and so forth.

In developing the installation instructions, the applicant may consult local avionics repair stations, the ACO, and Airworthiness Safety Inspectors from the FAA local Flight Standards District Office. Their assistance may provide insight about the information required for the installation instructions. The resulting AML STC should reduce the requirements of Flight Standards to issue follow-on field approvals for similar equipment installations.

5.5 What considerations should be made when developing an AML STC conformity inspection plan?

Conformity inspections are conducted to ensure that an aircraft component or modification conforms to the data submitted to the FAA and that the product being certificated complies with the Type design. These inspections physically compare the component or modification to the engineering specifications, drawings, and the airworthiness standards.

Experience shows that the requirement for conformity inspection of non-required equipment installations can be reduced in an acceptable manner. Depending on the airplanes listed on the AML, only one set of conformity inspections may be required.

The conformity plan should be well defined in the certification plan and must have FAA concurrence.

FAA Order 8100.4B and AC 21-40, Application Guide for Obtaining a Supplemental Type Certificate, provide more details on conformity inspections.

5.6 What considerations should be made when developing an AML STC flight test plan?

Flight testing may be necessary to verify that the system performs its intended function and does not adversely affect essential and critical systems. The flight test will generally be devoted to:

- evaluation of the pilot's ability to safely operate the equipment
- acceptability of the placement of the MFD equipment
- determination if equipment operation interferes with the operation of required systems
- determination if the equipment performs the intended functions

The AML STC should consider aspects of each eligible model to develop an approved test plan.

AC 23-8A, Flight Test Guide for Certification of Part 23 Airplanes, provides further guidance on flight test issues.

5.7 What are the Human Factors concerns?

A major concern is placement of the MFDs in the cockpit. They should perform their function without distracting the pilot from safely operating the aircraft. The FAA has recognized the need to address human factors issues along with pilot flight test evaluations due to the unique operational and pilot interface issues that require consideration.

The PSCP should include either a separate human factors plan or incorporate the human factors considerations in the overall certification plan. Guidance to assist in

this effort along with other human factors considerations are contained in the proposed FAA Policy Statement PS-ACE100-2001-004. This document gives an overview of what should be included in a certification plan to address human factors considerations.

Additional human factors considerations can be found in GAMA Publication No. 10 which provides industry accepted guidance on human factors cockpit design for part 23 Small Airplanes. AC 23-1311-1A, TSO-C113 and the FAA and Industry Guide to Avionics Approvals also provide human factors guidance for MFDs.

5.8 Is an Airplane Flight Manual (AFM) supplement required?

A determination will need to be made if AFM action is necessary. This will depend on the need for limitations based on the equipment, operational complexity and the compelling nature of the MFD to draw the pilot's attention.

If it is determined that an AFM supplement should be developed, it needs to address the equipment limitations and operations. A generic supplement can be developed for all approved models. The generic supplement is then inserted into the existing flight manual with the cover page completed for make and model, registration number and serial number.

A dedicated AFM section should address any equipment operation limitations. For example, a MFD may be limited to "Situation Awareness Only" or "VFR Navigation Only. " The limitations are then stated in the flight manual supplement such as:

- Situation Awareness Only
- VFR Navigation Only
- Not approved for primary navigation

A placard near the MFD is an effective way of conveying limitations to the pilot.

The AFM is also the appropriate place to insert the operational instructions of the installed equipment. This information should give instructions to properly operate the equipment including any pre-flight test procedures, abnormal procedures and emergency procedure requirements. The AFM may also refer to equipment user manuals for more in-depth instructions on operating the equipment. Examples of instruction items include:

- Operators manual must be accessible to aircrew in flight
- Approved software revision status
- User manual status
- Required equipment placards

FAA AC 23-8A, Flight Test Guide for Certification of part 23 Airplanes, chapter 6, section 3, provides additional guidance on airplane flight manual and approved manual material.

Note 2: If the airplane does not require an AFM, a “Supplemental Flight Manual” should be developed to provide the same information.

5.9 What requirements are there for Instructions for Continued Airworthiness (ICA)?

An ICA is required as part of the AML STC data package. Part 21.50(b) states that a holder of an STC shall furnish at least one set of complete Instructions for Continued Airworthiness prepared in accordance with § 23.1529 Appendix G or § 31.82 Appendix A. Each appendix provides a checklist to assist in development of an acceptable ICA.

The ICA provides instructions necessary for certificated personnel to inspect and maintain the additional equipment installed by the AML STC per requirements of §§ 43.13(a) and 43.16.

The ACO engineer is responsible under § 21.50 for the compliance findings for requirements of the ICA as well as approving the airworthiness limitations section, if required. The Aircraft Evaluation Group (AEG) will assist the ACO engineer in establishing the adequacy of the ICA and determining the acceptability of the ICA.

The ICA must be in completed printed form when the first airworthiness certificate is issued, or before delivery of the first product, whichever is later.

FAA Order 8110.4B and Flight Standards Handbook Bulletin for Airworthiness (HBAW) 98-18 offers further guidance on the development of the ICA documents.

6.0 Reference and Guidance Material

- Advisory Circular (AC) 20-140, Guidelines for Design Approval of Aircraft Data Communications Systems
- AC 21-40, Application Guide for Obtaining a Supplemental Type Certificate

- AC 23.1309-1C, Equipment, Systems, and Installation in Part 23 Airplanes
- AC 23.1311-1A, Installation of Electronic Displays in Part 23 Airplanes
- AC 23-15, Small Airplane Certification Compliance Program, Section 4(v) provides guidance on accepted methods of performance evaluation of equipment installations
- AC 23-17, Systems and Equipment Guide for Certification of Part 23 Airplanes
- AC 23-8A, Flight Test Guide for Certification of Part 23 Airplanes, Chapter 5 provides guidance for performance evaluation of equipment and Chapter 6 provides AFM guidance
- AC 43.13-1B, Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair
- AC 43.13-2A, Acceptable Methods, Techniques, and Practices - Aircraft Alterations
- Order 8100.5, Aircraft Certification Directorate Procedures
- Order 8110.4B, Type Certification
- Order 8150.1A, Technical Standard Order Procedures
- Order 8300.10, Airworthiness Inspector's Handbook Volume 2, Chapter 1, Perform Field Approval of Major Repairs and Major Alterations
- Notice 8110.80, The FAA and Industry Guide to Product Certification
- Notice 8110.92, Guidelines for Applying the RTCA-DO-178B Level D Criteria to Previously Developed Software (PDS)
- Proposed FAA Policy Statement PS-ACE100-2001-004, Guidance for Reviewing Certification Plans to Address Human Factors for Certification of Part 23 Small Airplanes
- The FAA and Industry Guide to Product Certification January 1999

- The FAA and Industry Guide to Avionics Approvals April 2001
- GAMA Publication Number 10, Recommended Practices and Guidelines for Part 23 Cockpit/Flight Deck Design
- Flight Standards Handbook Bulletin for Airworthiness (HBAW) 98-18

These documents may be accessed through the FAA's website at (<http://av-info.faa.gov>).

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